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For: Programmable Controller for Controlling an Output State

### CLAIMS

1           1.     A programmable controller for controlling an output state based on position  
2 indicated from a position transducer, comprising:  
3           an interface to the position transducer that converts the transducer signals into a change in  
4 position;  
5           a transducer position counter that accumulates the change in transducer position;  
6           a net forward position counter that accumulates the net forward position;  
7           means for comparing the value of the net forward position counter and the value of the  
8 transducer position counter;  
9           means to update the position counter when the transducer signals indicate a change of  
10 position; and  
11           means to update the net forward position counter when the value of the net forward  
12 position counter and the value of the transducer position counter are equal and the transducer  
13 interface indicates a forward movement.

1           2.     The programmable controller of claim 1, further comprising means for disabling  
2 an output state when the transducer position does not match the net forward position.

1           3.     The programmable controller of claim 1, in which the transducer interface further  
2 converts the transducer signals into an index signal that occurs once per cycle in a repetitive  
3 operation cycle.

1           4.     The programmable controller of claim 3, further comprising means for setting the  
2 transducer position counter and the net forward position counter to zero when the index signal is  
3 detected and the transducer interface indicates a forward movement.

1           5.     The programmable controller of claim 4, further comprising means for setting a  
2 maximum position value, and comparison means for comparing the transducer position to the  
3 maximum position value.

1           6.     The programmable controller of claim 5, further comprising means for setting the  
2 transducer position counter to the maximum position value when the transducer position is zero  
3 and the transducer interface indicates a reverse movement.

1           7.     The programmable controller of claim 1, further comprising means for setting a  
2 maximum position value, and comparison means for comparing the transducer position to the  
3 maximum position value.

1           8.     The programmable controller of claim 7, further comprising means for setting the  
2 transducer position counter and the net forward position counter to zero when the transducer  
3 position is equal to the maximum position value and the transducer interface indicates a forward  
4 movement.

1           9.     The programmable controller of claim 8, further comprising means for setting the  
2 transducer position counter to the maximum position value when the transducer position is zero  
3 and the transducer interface indicates a reverse movement.

1           10.    A programmable controller for controlling an output state based on position  
2 indicated from a position transducer, comprising:  
3           an interface to the position transducer that converts the signals into a change in position;  
4           a storage means for storing the transducer position;  
5           a storage means for storing the net forward position;  
6           comparison means for comparing the stored value of the net forward position and the  
7 stored value of the transducer position;

8 logic means for adding or subtracting the change in position to or from the transducer  
9 position;

10 logic means to update the storage means of the transducer position with the result of the  
11 addition or subtraction; and

12 logic means to update the storage means of the net forward position with the result of the  
13 addition when the stored value of the net forward position and the stored value of the transducer  
14 position are equal and the transducer interface indicates a forward movement.

1 11. The programmable controller of claim 10, in which the transducer interface  
2 further converts the transducer signals into an index signal that occurs once per cycle in a  
3 repetitive operation cycle.

1 12. The programmable controller of claim 11, further comprising means for setting  
2 the transducer position storage means and the net forward position storage means to zero when  
3 the index signal is detected and the transducer interface indicates a forward movement.

1 13. The programmable controller of claim 10, further comprising means for setting a  
2 maximum position value, and means for comparing the transducer position to the maximum  
3 position value.

1 14. The programmable controller of claim 13, further comprising means for setting  
2 the transducer position storage means and the net forward position storage means to zero when  
3 the transducer position is equal to the maximum position value and the transducer interface  
4 indicates a forward movement.

1 15. The programmable controller of claim 14, further comprising means for setting  
2 the transducer position storage means to the maximum position value when the transducer  
3 position is zero and the transducer interface indicates a reverse movement.

1           16.     A programmable controller, comprising means for controlling an output state  
2     based on position indicated from a position transducer, and means for signaling the occurrence of  
3     an event based on position indicated from the position transducer.

1           17.     The programmable controller of claim 16, wherein the event signal comprises an  
2     interrupt.

1           18.     A programmable controller having a programmable processor, the controller for  
2     controlling an output state based on position indicated from a position transducer, comprising:  
3             an interface to the position transducer that converts the transducer signals into a change in  
4     position;  
5             means for accumulating the changes in position and storing the resulting transducer  
6     position;  
7             means for storing a selected position value;  
8             means for comparing the selected position value with the stored transducer position; and  
9             means, responsive to the means for comparing, for signaling the programmable processor  
10    when the selected position value is equal to the transducer position.

1           19.     The programmable controller of claim 18, further comprising:  
2             means for storing a selected event value; and  
3             means for the programmable processor to read the selected event value.

1           20.     The programmable controller of claim 18, further comprising means for reloading  
2     a new selected position value after the selected position value and the transducer value are equal  
3     and the programmable processor has been signaled.

1           21.     A programmable controller for controlling an output state based on position  
2     indicated from a position transducer, comprising:

3 an interface to the position transducer that converts the transducer signals into a change in  
4 position;

5 a counter that accumulates the change in transducer position;

6 means to update the counter when the transducer signals indicate a change of position;

7 means for storing a selected position value;

8 means for comparing the selected position value with the stored transducer position;

9 delay means to create a delay;

10 means for storing the value of the time delay,

11 means to load the value of the time delay with a specified delay and begin the delay when  
12 the selected position value matches the transducer position; and

13 means to change the output value when the selected position matches the stored  
14 transducer position, and means to change the output value when the time delay completes.

1 22. The programmable controller of claim 21, further comprising  
2 means for storing two output values; and  
3 means to output the first output value when the selected position matches the stored  
4 transducer position, and output the second output value when the time delay completes.

1 23. The programmable controller of claim 21, further comprising a timer and an  
2 output value pair for each output of the controller.

1 24. A programmable controller for controlling an output state based on position  
2 indicated from a position transducer, comprising:

3 an interface to the position transducer;

4 a master-position counter;

5 one or more offset-position counters;

6 means for defining a maximum position value;  
7 means for indicating when the master-position counter has reached maximum position  
8 value;  
9 means for storing one offset value for each offset-position counter; and  
10 means for loading the stored offset value of each offset-position counter when the master-  
11 position counter has reached its maximum value.

1 25. The programmable controller of claim 24, further comprising:  
2 means for indicating the next setpoint position to change the output;  
3 a means for comparing the value in the master-position counter or one of the offset-  
4 position counters with the value of the setpoint position and indicating a match if the two values  
5 are equal;  
6 means for indicating a next-output value to be set when a match occurs; and  
7 an output driver for producing an output state from the next output value when the match  
8 occurs.

1 26. A programmable controller for controlling an output state during a repetitive  
2 operation cycle, comprising:  
3 a hardware timer for measuring the period of the repetitive operation cycle;  
4 means for specifying a maximum cycle value; and  
5 compare logic for disabling the outputs when the measured period is greater than the  
6 maximum cycle value.

1 27. The programmable controller of claim 26, further comprising means for  
2 specifying a minimum cycle value, wherein the compare logic disables the outputs when the  
3 measured period is greater than the maximum cycle value or less than the minimum cycle value.

1           28.     A programmable controller for controlling an output state based on position  
2 indicated from a position transducer, comprising:  
3           an interface to the position transducer that converts the transducer signals into a change in  
4 position;  
5           a counter that accumulates the change in transducer position;  
6           means to update the counter when the transducer signals indicate a change of position;  
7           means for storing a selected position value;  
8           means for comparing the selected position value with the stored transducer position;  
9           delay means to create a delay based on change in position;  
10          means for storing the value of the positional delay,  
11          means to load the value of the positional delay with a specified delay and begin the delay  
12 when the selected position value matches the transducer position.

1           29.     The programmable controller of claim 28, further comprising means to change the  
2 output value when the selected position matches the stored transducer position, and means to  
3 change the output value when the position delay completes.

1           30.     The programmable controller of claim 28, further comprising  
2           means for storing two output values; and  
3           means to output the first output value when the selected position matches the stored  
4 transducer position, and output the second output value when the time delay completes.